V2500 International Aero Engines
SERVICE BULLETIN

ENGINE - FUEL AND CONTROL - TO PROVIDE A NEW A5SCN14/S ELECTRONIC ENGINE CONTROL (EEC)

MODEL APPLICATION

V2522-A5
V2524-A5
V2527-A5
V2527E-A5
V2527M-A5
V2530-A5
V2533-A5

BULLETIN INDEX LOCATOR

73-22-00

Compliance Category Code

8

Internal Reference No.

99VZ002

Jul.30/99

ENGINE - FUEL AND CONTROL - TO PROVIDE A NEW A5SCN14/S ELECTRONIC ENGINE CONTROL (EEC)

1. Planning Information

A. Effectivity

(1) Aircraft: Airbus A319, A320, A321

(2) Engine: V2522-A5 Engines Serial No. V10999
V2524-A5 Engines Serial No. V10999
V2527-A5 Engines Serial No. V10999
V2527E-A5 Engines Serial No. V10999
V2527M-A5 Engines Serial No. V10999
V2530-A5 Engines Serial No. V10999
V2533-A5 Engines Serial No. V10999

CAUTION: THE INTERMIX OF ELECTRONIC ENGINE CONTROLS MUST BE DONE BY THE INSTRUCTIONS GIVEN IN REFERENCE (3), AIRBUS SERVICE BULLETIN A320-73-1068.

B. Reason

(1) Condition:

(a) 1.0 A319 V2527M-A5 EPR POWERSETTING REQUIREMENTS

(b) 1.1 NEW THRUST RATING

1 1.1 A new 27000 lb. thrust rating is required for the A319 business jet application which provides for increased thrust levels relative to existing A319-22K and 24K ratings. The new engine model for the installation shall be designated the V2527M-A5.

(c) 1.2 BLEED LOCKUP DURING TAKEOFF

1 1.2 During takeoff operation, bleed EPR resets for takeoff EPR powersetting are locked to protect against potential fluctuations in engine power as a result of cycling bleeds or other problems in the aircraft service bleed system. Currently, bleed EPR resets for max climb and max continuous ratings are not locked during takeoff, even though for some thrust ratings at certain flight condition, there is a potential that MCL or MCT powersettings could influence takeoff EPR calculation. Thus, with current EEC logic, there is still a potential for fluctuations in takeoff thrust due to aircraft bleed system problems.

(d) 2.0 A319 TAKE-OFF/GO-AROUND DISASSOCIATION.

1 2.1 The new 27000 lb thrust rating (V2527M-A5) has been incorporated in this software change (see 1.1). This new rating will have the take-off thrust of the current A320-233 Aircraft (V2527E-A5). However, in order to keep the current Aircraft handling quality in flight, this new rating will require that the thrust for go-around be kept at the current A319 levels (V2524-A5).

(e) 3.0 EGT FILTERING FOR OFF-IDLE EGT SPIKE REDUCTION

1 3.0 In order to address the problem of engine rundowns due to high pressure compressor (HPC) stall, scheduling of the HPC 7A bleed was previously revised such that the bleed will always be commanded open during low power on-ground operation. Opening of this bleed valve raises a concern that deteriorated engines under hot day conditions may experience momentary EGT redline exceedance as a result of off-idle EGT spikes which occur immediately following throttle advance during ground taxi or takeoff operation.

(f) 4.0 FUEL FLOW INTEGRATOR LIMIT

1 4.0 The software has a coding error where a switch does not function. The switch chooses between two different limits on the fuel flow integrator. The error has no functional affect on the software operation because the limits are currently the same value.

NOTE: This problem was originally discovered during the certification of the previous version of software.

(g) 5.0 DEFAULT EPR MODIFIER FOR A319 SINGLE CHANNEL DISPATCH

1 5.0 As currently configured, the EEC will switch from EPR mode to rated N1 mode for all single channel operation. The basis for this is that the data entry plug input necessary to determine the CDX EPR modifier class is split between the two channels. Therefore, if one channel is failed or if there is a failure that prevents communication between channels, the proper modifier cannot be determined. For the A319 Aircraft, thrust overboost protection requires an N1 cross channel check when operating in the N1 mode. Without this cross check, the thrust overboost protection system cannot meet the required reliability criteria necessary for aircraft dispatch. Thus, single channel operation is currently a non-dispatchable configuration for the A319 aircraft.

(h) 6.0 IGNITION ROTARY SELECTOR SWITCH FAULT DETECTION ENHANCEMENT

1 6.0 Experience has shown that slow pilot movement of the ignition rotary selector switch can result in nuisance faults against the aircraft Engine Interface Unit (EIU) computer.

(i) 7.0 ELIMINATION OF DUPLICATE FLIGHT WARNING COMPUTER MESSAGE FOR LOSS OF EIU ARINC BUS

1 7.0 The loss of the ARINC EIU input to the EEC results in two messages being displayed in the cockpit, one pointing to the EIU and the other pointing to the reverser system. Both messages indicate that the thrust reverser system is inoperative. There is an overall design requirement to have only one message displayed for given problem.

(j) 8.0 MENU MODE THRUST REVERSER TEST (ARMING VALVE) ENHANCEMENT

1 8.0 The menu mode thrust reverser test does not always detect an arming valve failed open condition with the shutoff valve not installed. This failure will be detected in normal mode any time the aircraft hydraulic system is available.

(k) 9.0 MENU MODE THRUST REVERSER TEST (SHUTTOFF VALVE) CHANGES

1 9.0 The menu mode thrust reverser test does not allow for slow movement of the throttle. If the throttle is moved slowly, the test will time-out before the shutoff valve is tested. In addition, it is not possible to restart the test without exiting menu mode after time-out.

(l) 10.0 ENGINE AT OR ABOVE IDLE ARINC BIT

1 10.0 There is no cockpit indication to indicate successful engine re-light in flight. New cockpit computer logic requires indication that the engine has been successfully started.

(m) 11.0 PROVISION FOR FUTURE DELETION OF 10TH STAGE MAKE-UP AIR (TURBINE COOLING) SOLENOID CONTROL UNIT

1 11.0 In the future, the 10th stage make-up air solenoid control valve will no longer be installed on production engines. High pressure turbine (HPT) supplement cooling air will flow during the cruise condition with the solenoid control valve removed.

(n) 12.0 MENU MODE STARTER VALVE/FMU MAX FLOW CHECK

(o) 12.1 NUISANCE FAULTS

1 12.1 The menu mode Starter Valve/FMU max flow test, which is used to confirm the correct FMU standard has been installed on the (A319, A320, A321) aircraft, produces nuisance faults.

(p) 12.2 NUISANCE FAULTS-DEP DISABLE OF FMU TEST ON A320

1 12.2 The menu mode Starter Valve/FMU max flow test has been redesigned in this SCN to distinguish between two FMU's: A lower flow FMU for the A319 and A320 (referred to as the A319/A320 common FMU) and a higher flow FMU for the A321. The FMU test is designed to declare a high flow FMU on an A320 as a failure.

(q) 12.3 UNDESIRED TEST ABORTS

1 12.3 The menu mode Starter Valve/FMU max flow test must be run several times before it runs successfully.

(r) 12.4 FMU COMMAND LEFT "ON" AFTER ABORT

1 12.4 When the Starter Valve/FMU max flow test aborts while the FMU torque motor is being commanded, the test aborts but leaves the FMU torque motor commanded. This is not a hazardous condition because the shutoff valve is closed.

(s) 12.5 POTENTIAL NUISANCE MESSAGE DUE TO FAILED DATA ENTRY PLUG

1 If the Starter Valve/FMU max flow test is run on an A319 or A320 Aircraft with a failed data entry plug, the test will erroneously indicate "FMU Fuel Flow is too small for Aircraft".

(t) 13.0 THRUST OVERBOOST PROTECTION

1 13.0 For the A319 aircraft installation, the airframe manufacturer requires that the EEC provide for thrust overboost protection which, in the event of a fuel system or other potential failure, will limit engine thrust to protect the stability of the aircraft. Recently, the airframe manufacturer revised the engine thrust limit for overboost protection. In addition, the calculated FMU maximum fuel flow limit has been re-evaluated and shown to be higher than previously determined. The thrust overboost protection logic must be revised to reflect the latest requirements.

(u) 14.0 MENU MODE IGNITOR TEST - ADDITIONAL PROTECTION AGAINST INADVERTENT STARTING DUE TO IMPROPER PROCEDURE

1 14.0 A start sequence can be launched from the menu mode Ignitor System Test if the rotary selector switch is inappropriately moved from the NORM position to the IGN (ignition) position. Movement of the rotary selector switch during the Ignitor System Test is against procedure. If the rotary selector switch is moved, it can create a hazardous condition for maintenance personnel who may be near the engine (listening for the ignitors) if a start is initiated.

(v) 15.0 FUEL RETURN TO TANK LINE TEST

1 15.0 The Aircraft Maintenance Manual procedure, Task 73-13-42-720-010, "Functional Test of the Fuel re-circulation cooling system", needs to be simplified. The procedure is applied during a Fuel Return-to-Tank Line Check. The Fuel Return-to-Tank Line Check requires an external simulation of a 100 degree C IDG temperature with special tooling to cause the spill valve to open so that the fuel return-to-tank line can be pressurized.

(w) 16.0 TLA DISAGREEMENT FAULT LOGIC ENHANCEMENT

1 16.0 During approach phase, an intermittent disagreement between the TLA signals going to the EEC can cause engine speed variations between idle and selected TLA. The Class I cockpit message, "ENG THRUST LEVER DISAGREE", will be displayed if the TLA fault occurs.

(x) 17.0 NEW RECORDED MAINTENANCE FAULTS FOR THE EEC150-40

1 17.0 The EEC software is being modified to accommodate the ability to run in the existing EEC150-20 and the new EEC150-40 hardware. This will be certified in the near future. As part of this change, certain new faults related to the EEC need to be recorded for troubleshooting internal EEC problems.

(2) Background:

(a) 1.0 A319 V2527M-A5 EPR POWERSETTING REQUIREMENTS

(b) 1.1 NEW THRUST RATING

1 1.1 New requirement.

(c) 1.2 BLEED LOCKUP DURING TAKEOFF

1 1.2 Current logic design does not account for potential overlap which can occur between takeoff, MCT, and MCL powersettings, particularly for lower thrust ratings such as the A319 22K and 24K.

(d) 2.0 A319 TAKE-OFF/GO-AROUND DISASSOCIATION.

1 2.1 New Requirement.

(e) 3.0 EGT FILTERING FOR OFF-IDLE EGT SPIKE REDUCTION

1 3.0 EGT spikes are caused by the initial addition of fuel immediately following movement of the throttle off the idle position. Slow response of the low rotor relative to the high rotor results in the EGT probes being exposed to a momentary high gas path temperature. Opening of engine stability bleeds will raise the pre-spike EGT thereby increasing the threat of a redline exceedance. EGT spikes are not harmful to engine hot section hardware since metal temperatures do not have sufficient time to respond to short duration changes in gas path temperature.

(f) 4.0 FUEL FLOW INTEGRATOR LIMIT

1 4.0 Coding error.

(g) 5.0 DEFAULT EPR MODIFIER FOR A319 SINGLE CHANNEL DISPATCH

1 5.0 Current powersetting selection logic was developed based on the A320 and A321 Aircraft which do not require special thrust overboost protection and can be dispatched (10 days maximum) in the N1 mode with one channel of the EEC inoperable.

(h) 6.0 IGNITION ROTARY SELECTOR SWITCH FAULT DETECTION ENHANCEMENT

1 6.0 Slow movement of the ignition rotary switch was not built into the design of the EIU or the EEC software.

(i) 7.0 ELIMINATION OF DUPLICATE FLIGHT WARNING COMPUTER MESSAGE FOR LOSS OF EIU ARINC BUS

1 7.0 Redundant requirements for the two cockpit messages were incorporated in the EEC software.

(j) 8.0 MENU MODE THRUST REVERSER TEST (ARMING VALVE) ENHANCEMENT

1 8.0 The thrust reverser menu mode test window is not long enough to detect the arming valve failed open condition with the shutoff valve not installed.

(k) 9.0 MENU MODE THRUST REVERSER TEST (SHUTTOFF VALVE) CHANGES

1 9.0 A 60 second time-out was incorporated as a safety feature. Slow throttle movements were not considered as part of the original requirements.

(l) 10.0 ENGINE AT OR ABOVE IDLE ARINC BIT

1 10.0 New requirement.

(m) 11.0 PROVISION FOR FUTURE DELETION OF 10TH STAGE MAKE-UP AIR (TURBINE COOLING) SOLENOID CONTROL UNIT

1 11.0 It has been determined that the engine efficiency gained from the 10th stage make-up air system is not justified as compared to the cost of maintenance and increased complexity of the engine.

(n) 12.0 MENU MODE STARTER VALVE/FMU MAX FLOW CHECK

(o) 12.1 NUISANCE FAULTS

1 12.1 The FMU check has proved to be unreliable due to the fuel flow trip points used in the logic for measuring metering valve resolver angle. The original trip point values were chosen from available data at that time.

(p) 12.2 NUISANCE FAULTS-DEP DISABLE OF FMU TEST ON A320

1 12.2 The field retrofit of the A320 fleet from the high flow FMU to the A319/A320 common FMU is on going. Until the retrofit is complete, the menu mode FMU test is not valid for the A320 because it can have a high flow or an A319/A320 common flow FMU installed. If a high flow FMU were installed, an inappropriate failure indication would result during the FMU test.

(q) 12.3 UNDESIRED TEST ABORTS

1 12.3 The processing of the engine speed signal (N2) in menu mode is less accurate than normal mode. This results in noise on the speed signal that causes the test to abort.

(r) 12.4 FMU COMMAND LEFT "ON" AFTER ABORT

1 12.4 The menu mode test does not properly handle test aborts while the FMU is being commanded.

(s) 12.5 POTENTIAL NUISANCE MESSAGE DUE TO FAILED DATA ENTRY PLUG

1 For a data entry plug failure, the aircraft model is assumed to be A321. The FMU for an A319 or A320 Aircraft will be considered too small for the assumed A321 Aircraft

(t) 13.0 THRUST OVERBOOST PROTECTION

1 13.0 New requirement.

(u) 14.0 MENU MODE IGNITOR TEST - ADDITIONAL PROTECTION AGAINST INADVERTENT STARTING DUE TO IMPROPER PROCEDURE

1 14.0 During the menu mode Ignitor System Test, the master lever must be turned on to supply 115V to the ignitor system and to enable the test. If the rotary selector switch is subsequently moved from the NORM position (to IGN position), menu mode is exited, thereby returning the control to normal mode. In normal mode, the master lever ON with the rotary selector in the IGN position sets the appropriate conditions to invoke an automatic start. If there is sufficient starter air pressure, the engine will start.

(v) 15.0 FUEL RETURN TO TANK LINE TEST

1 15.0 Product improvement.

(w) 16.0 TLA DISAGREEMENT FAULT LOGIC ENHANCEMENT

1 16.0 In approach phase, the EEC software selects forward idle thrust when there is a disagreement between the TLA signals for greater than 1 second. If the TLA signals agree for 5 seconds, the EEC will reselect the throttle-commanded TLA. Therefore, if the failure is intermittent, the engine thrust setting can change in an intermittent way, between the throttle-commanded state and idle.

(x) 17.0 NEW RECORDED MAINTENANCE FAULTS FOR THE EEC150-40

1 17.0 New Requirements.

(3) Objective:

(a) 1.0 A319 V2527M-A5 EPR POWERSETTING REQUIREMENTS

(b) 1.1 NEW THRUST RATING

1 1.1 Incorporate new takeoff, max continuous, and max climb EPR powersettings for the V2527M-A5. The V2527M-A5 rating will have the same takeoff thrust as the current A320-233 Aircraft, V2527E-A5. However, the go-around thrust will be kept at the A319 levels, V2524-A5

(c) 1.2 BLEED LOCKUP DURING TAKEOFF

1 1.2 Use the existing takeoff bleed EPR reset locking logic to lock the status of the MCL and MCT bleed EPR resets during takeoff position.

(d) 2.0 A319 TAKE-OFF/GO-AROUND DISASSOCIATION.

1 2.1 Incorporate the ability to distinguish between take-off phase and the rest of the flight for EPR powersetting. Two new Class I ECAM faults were added as part of this change:

TOTONG- A319 27M rating take-off/go-around selection logic non-dispatchable.

GND3FL- This is the same indication as TOTONG except it is reported during the menu mode FADEC self test.

Both TOTONG and GND3FL have the same clear language message (CLM):

ATA 341300, CLM99-ADIRS 1/ADIRS 2/LGCIU@

Where, @ equals "1" or "2" depending on engine position.

(e) 3.0 EGT FILTERING FOR OFF-IDLE EGT SPIKE REDUCTION

1 3.0 Incorporate increased filtering of the EGT signal for low power, on-ground operation such that momentary EGT spikes will not result in cockpit indicated EGT exceeding redline limits. This additional filtering is intended to alleviate off-idle spike concerns; it will not impact EGT response during starting, at takeoff power, or at other conditions for which EGT response is deemed critical.

(f) 4.0 FUEL FLOW INTEGRATOR LIMIT

1 4.0 Correct the code to match requirements.

(g) 5.0 DEFAULT EPR MODIFIER FOR A319 SINGLE CHANNEL DISPATCH

1 5.0 For the A319 Aircraft, modify powersetting selection logic such that the EEC will remain in the EPR mode for single channel operation, provided that there in not some other failure (P5, P2, etc.) which invalidates the EPR mode. Since there is not sufficient information to determine the appropriate CDX EPR modifier, set the modifier to the max level to ensure that minimum rated thrust requirements will be satisfied for all engines.

(h) 6.0 IGNITION ROTARY SELECTOR SWITCH FAULT DETECTION ENHANCEMENT

1 6.0 Increase the confirmation time of the fault detection logic from 1 to 5 seconds so that the nuisance fault will not occur during normal operation.

(i) 7.0 ELIMINATION OF DUPLICATE FLIGHT WARNING COMPUTER MESSAGE FOR LOSS OF EIU ARINC BUS

1 7.0 Remove the requirement for the reverser system fault message to be set. The EIU fault message is sufficient for the cockpit warning that the reverser system is inoperative.

(j) 8.0 MENU MODE THRUST REVERSER TEST (ARMING VALVE) ENHANCEMENT

1 8.0 Modify the logic so that an arming valve failed open condition is detected under all configurations of the reverser system.

(k) 9.0 MENU MODE THRUST REVERSER TEST (SHUTTOFF VALVE) CHANGES

1 9.0 Modify the time-out feature to look for throttle movement within the 60-second window. The test should continue to run until the shutoff valve test is complete as long as the throttle is moved to stow the reverser within the 60-second window. In addition, modify the design such that the test can be rerun without exiting menu mode if a time-out does occur. These changes allow all the parts of the reverser test to be run without compromising the safety aspects of the original design.

(l) 10.0 ENGINE AT OR ABOVE IDLE ARINC BIT

1 10.0 Upon successful completion of either an automatic start or manual start, an indication that the engine has reached idle speed will be provided over ARINC.

(m) 11.0 PROVISION FOR FUTURE DELETION OF 10TH STAGE MAKE-UP AIR (TURBINE COOLING) SOLENOID CONTROL UNIT

1 11.0 Develop logic in the EEC to determine if the 10th stage make-up air solenoid control valve is installed on the engine. If it is installed, control it normally. If it is not installed, then do not allow the fault detection logic to produce nuisance messages. In addition, for production engines, the HPT cold built blade tip clearances will be reduced in conjunction with this change to negate the slight performance debit associated with the flowing of 10th stage makeup air at cruise.

(n) 12.0 MENU MODE STARTER VALVE/FMU MAX FLOW CHECK

(o) 12.1 NUISANCE FAULTS

1 12.1 Modify the FMU test to make it less prone to nuisance faults by simplifying the check by employing a single fuel flow trip point. The test will now distinguish between two FMU's, a lower flow FMU for the A319 and A320 and a higher flow FMU for the A321.

One Class II ECAM fault was deleted as part of this change:

FMLOW- FMU fuel flow is too low. This is a menu mode fault only.

ATA 732200, CLM 98-FMU/DEP@

Where, @ equals "1" or "2" depending on engine position.

NOTE: The CLM is not deleted. There are still Two faults that will display this CLM.

(p) 12.2 NUISANCE FAULTS-DEP DISABLE OF FMU TEST ON A320

1 12.2 Modify the FMU test to allow the test to be disabled for the A320 via the DEP. All current A320 DEP configurations will disable the FMU test for the A320. Once the retrofit of the FMU is complete, the DEP's for the A320 can be retrofit (by rewiring) to enable the FMU test.

(q) 12.3 UNDESIRED TEST ABORTS

1 12.3 Modify the processing of the Engine Speed signal (N2) in menu mode such that once the speed signal is declared valid, assume it remains valid for the duration of the 5 second test.

(r) 12.4 FMU COMMAND LEFT "ON" AFTER MAX ABORT

1 12.4 Modify the menu mode test so that any abort will depower the FMU torque motor.

(s) 12.5 POTENTIAL NUISANCE MESSAGE DUE TO FAILED DATA ENTRY PLUG

1 Modify the menu mode test so that data entry plug failures will cause the test to abort and not produce nuisance faults.

(t) 13.0 THRUST OVERBOOST PROTECTION

1 13.0 Revise EEC stability bleed scheduling for thrust overboost protection such that the airframe manufacturer requirements will be satisfied with the higher FMU max fuel limit. In order to satisfy these requirements, scheduling of engine stability bleeds must be modified to allow for a bleed configuration in which the 2.5 bleed is commanded to the half open position. The required maintenance action after an overboost event will not change.

(u) 14.0 MENU MODE IGNITOR TEST - ADDITIONAL PROTECTION AGAINST INADVERTENT STARTING DUE TO IMPROPER PROCEDURE

1 14.0 During the ignitor test, after the master lever has been turned ON, the rotary selector switch position will be ignored by the EEC logic. The EEC will remain in menu mode so that the normal mode start logic will not be invoked. Also, the following text will be added to the menu mode screen warning against movement of the rotary selector switch: "WARNING: KEEP ENGINE MODE SEL SWITCH IN NORM".

(v) 15.0 FUEL RETURN TO TANK LINE TEST

1 15.0 Modify the EEC logic so that the Fuel Return-to-Tank Line Check can be performed during a wet crank. The EEC will command the spill valve to the full open position during a wet crank to pressurize the line so that it can be checked for leaks.

One new Class III fault will be added as part of this change:

SPVFC -Spill valve failed closed

ATA 731342, CLM 14-FUL DIV RET VLV/HC/EEC@

Where, @ equals "1" or "2" depending on engine position.

NOTE: CLM 14 is an existing Clear Language Message.

(w) 16.0 TLA DISAGREEMENT FAULT LOGIC ENHANCEMENT

1 16.0 Modify the EEC logic so that during approach phase, as determined by the slats transitioning from retracted to extended, a TLA disagreement fault will be permanently latched to prevent an intermittent fault from causing thrust setting fluctuations. The fault will be latched when the TLA signals disagree for a cumulative time (not necessarily continuous) of 3 seconds.

(x) 17.0 8. NEW RECORDED MAINTENANCE FAULTS FOR THE EEC150-40

1 17.0 Enhance fault recording with the addition of seven new faults that will aid in isolating internal EEC problems with the new EEC150-40 hardware.

NOTE: These faults identify problems with the EEC150-40 and will therefore only be seen with the EEC150-40, not with the EEC150-20.

Three new Classes I faults will be added as part of this change:

LOADIS- Disagreement of LOA (Loss of Activity)

LOAIN- Failed LOA circuit from the INCOM

LOAOUT- Failed LOA circuit from the OUTCOM

ATA 732234, CLM 1 - EEC@

Where, @ equals "1" or "2" depending on engine position.

One new Class II fault will be added as part of this change:

XMTRFI - ARINC Trainsmitter failed.

ATA 732234, CLM 1 - EEC@

Where, @ equals "1" or "2" depending on engine position.

Three new Scheduled Maintenance faults will be added as part of this change:

DPFLT- Double precision fault

FDLNG- Local F/D (Frequency to Digital) converter no good

FDRNG- Remote F/D (Frequency to Digital) converter no good

ATA 732234, CLM 1 - EEC@

Where, @ equals "1" or "2" depending on engine position.

NOTE: CLM 1 is an existing Clear Language Message.

(4) Substantiation

DO-178A Substantiation for final approval of the SCN14/S software standard is completed. Flight testing was successfully completed on Aircraft 977 (A320-232) April 4, 1999. Ground testing was successfully completed on Aircraft 977 (A320-232) April 1, 1999.

(5) Effects of Bulletin on Workshop Procedures:

Removal/Installation	Not affected
Disassembly/Assembly	Not affected
Cleaning	Not affected
Inspection/Check	Not affected
Repair	Not affected
Testing	Not affected

(6) Supplemental Information

None.

C. Description

(1) To provide a new Electronic Engine Control (EEC) with SCN14/S software logic.

Part I - If the Electronic Engine Control is sent to one of the addresses listed in Paragraph 2. B.

(a) A new EEC can be obtained from the supplier referenced in Part I of this Service Bulletin. The removed part is returned, programmed, identified with the new part number, and installed again.

Part II - If the Electronic Engine Control is Reprogrammed on site.

(b) The EEC can be programmed on the engine, by the procedure given in part II of this Service Bulletin, and identified with the new part number.

D. Approval

The Part Number Changes and/or part modifications described in Section 2 and 3 of this Service Bulletin have been shown to comply with the applicable Federal Aviation Regulations and are FAA-APPROVED for the Engine Model listed.

The change in definition subject to this Service Bulletin has been covered by Aircraft Modification number 28341/P5839 which is approved by the DGAC (Direction Generale De L' Aviation Civile - France).

E. Compliance

Category 8

Accomplish based upon experience with the prior configuration.

F. Manpower

Estimated Manhours to incorporate the full intent of Part I of this Service Bulletin (in service):

Venue	Estimated Manhours
(1) In service..	TOTAL: 1 hour 16 minutes
(a) To gain access	
(i) Install warning notices ..	5 minutes
(ii) Open the fan cowls	7 minutes
(iii) Remove the EEC	23 minutes
	TOTAL: 35 minutes
(b) To return to flyable status	
(i) Install the EEC	28 minutes
(ii) Close the fan cowls	8 minutes
(iii) Remove the warning notices	5 minutes
	TOTAL: 41 minutes

Estimated Manhours to incorporate the full intent of Part II of this Service Bulletin (in service):

Venue	Estimated Manhours
(2) In service..	TOTAL: 1 hour 25 minutes
(a) To gain access	
(i) Install warning notices ..	5 minutes
(ii) Open the fan cowls	7 minutes
(iii) Program the EEC .. .	1 hour
	TOTAL: 1 hour 12 minutes
(b) To return to flyable status	
(i) Close the fan cowls	8 minutes
(ii) Remove the warning notices	5 minutes
	TOTAL: 13 minutes

Estimated Manhours Part I or Part II (overhaul):

(3) At overhaul .. .. Not applicable

G. Material - Price and Availability

(1) Modification kit is not required.

(2) This Service Bulletin will be done at no cost to the operator for units that are reprogrammed in the field. See Paragraph 2., Accomplishment Instructions, Part II. Units that are returned to Hamilton Sundstrand Support Systems or Maastricht Aachen Airport to incorporate this Service Bulletin will be charged to the operator. See Paragraph 2., Accomplishment Instructions, Part 1.

H. Tooling - Price and Availability

The tools and equipment that follow are necessary to do the procedure given in Part II of this Service Bulletin.

(1) A dedicated (recommendation) IBM compatible computer, with the following minimum requirements:

(a) 80286 processor

(b) 512 Kbytes RAM

(c) 1.44 Mbyte, 3.5" floppy disk drive

(d) Dual channel RS-422 asynchronous communication board (HS recommends Model DS202 by Qua Tech Incorporated) with the following setup:

Channel A EEC - COM3 (Base address 2E8, IRQ level 5)

Channel B EEC - COM4 (Base address 3E8, IRQ level 5)

(e) MSDOS operating system (version 3.0 or higher)

(f) Virus scan program (such as "VI-SPY" or "McAfee" is recommended).

NOTE: The IBM computer date/time must be current prior to performing this procedure.

(2) Hamilton Sundstrand diskette referenced in Table 4. This diskette contains the EEC150-20: application code, trims, memory clear utilities, and software loader. The diskette can be obtained from:

IAE Customer Support
400 Main Street
M/S 121-10
East Hartford,
CT 06108 USA
Tel: 860-565-5515 Fax: 860-565-0600

Associated Engine Serial Numbers must be stated on all correspondence.

(3) EEC150-20 Programming Harness Definition as defined in Table 1.

EEC SIGNAL NAME	PROGRAMMING HARNESS CONNECTOR	QUA-TECH CONNECTOR	QUA-TECH SIGNAL NAME
UART IN LINE B CHA	P1-b	PA-2	TXD+
UART IN LINE A CHA	P1-H	PA-7	TXD-
UART OUT LINE A CHA	P1-c	PA-4	RXD+
UART OUT LINE B CHA	P1-J	PA-8	RXD-
BOOT DISC CHA	P1-D	N/A	N/A
BITE DISC CHA	P1-Z	N/A	N/A
BOOT/BITE RTN CHA	P1-m	N/A	N/A
UART IN LINE B CHB	P7-b	PB-2	TXD+
UART IN LINE A CHB	P7-H	PB-7	TXD-
UART OUT LINE A CHB	P7-c	PB-4	RXD+
UART OUT LINE B CHB	P7-J	PB-8	RXD-
BOOT DISC CHB	P7-D	N/A	N/A
BITE DISC CHB	P7-Z	N/A	N/A
BOOT/BITE RTN CHB	P7-m	N/A	N/A

Table 1
Programming Harness Definition

(4) BOOT/BITE switches defined as:

(a) Single pole, single throw

(b) Closed contact resistance of 50 ohms maximum

(c) Open contact resistance of 100 Kohms minimum

(d) Closed contact current of 20 mA minimum

(e) Open contact voltage of 20VDC minimum

and wired between BOOT DISC and BOOT/BITE RTN and BITE DISC and BOOT/BITE DISC for each channel. Reference Table 1 for EEC connector pins.

(5) EEC150-20 NAMEPLATE PN 751333-1 or modified nameplate 822815-1.

(6) 28 VDC +/- 0.5A power supply and associated power cables as defined in Table 2.

EEC SIGNAL NAME	POWER SUPPLY HARNESS CONNECTOR	POWER SUPPLY
GTP CHA	P3-m	+28VDC
GTP RTN CHA	P3-r	+28VDC RTN
GTP CHB	P9-m	+28VDC
GTP RTN CHB	P9-r	+28VDC RTN

Table 2
Power Supply Connections

I. Weight and Balance

(1) Weight change — None

(2) Moment arm — No effect

(3) Datum — Engine Front mount Centerline (Power Plant station (PPS) 100)

J. Electrical Load Data

This Service Bulletin has no effect on the aircraft electrical load.

K. References

(1) IAE V2500 Service Bulletins:

V2500-ENG-73-0052 (Engine - Fuel And Control - To Provide A New Electronic Engine Control (EEC) With The SCN9A Version 021/121 Software Configuration and Hardware Changes to Address Nacelle Drainage Requirements)

V2500-ENG-73-0080 (Engine - Fuel And Control - To Provide A New Electronic Engine Control (EEC) With The SCN10A Software Configuration Version 026/026 Trims)

V2500-ENG-73-0083 (Engine - Fuel And Control - To Provide A New Electronic Engine Control (EEC) With The SCN10B Software Configuration Version 027/027 Trims)

V2500-ENG-73-0086 (Engine - Fuel And Control - To Provide A New Electronic Engine Control (EEC) With The SCN11 Software Configuration Version 032/032 Trims)

V2500-ENG-73-0111 (Engine - Fuel And Control - To Provide A New SCN11/P (EEC))

V2500-ENG-73-0121)(Engine - Fuel And Control - To Provide A New SCN12/Q (EEC))

(2) Hamilton Sundstrand Service Bulletin:

EEC-150-20-73-16, Install Software Identification Plate.

EEC-150-20-73-23, Incorporation of New Software Configuration: A5 SCN14/S.

(3) Airbus Service Bulletin A320-73-1068.

(4) V2500 Aircraft Maintenance Manual.

(5) The V2500 Engine Illustrated Parts Catalog (S-V2500-2IA), Chapter/Section 73-22-34.

L. Other Publications Affected

(1) The V2500 Engine Illustrated Parts Catalog (S-V2500-2IA), Chapter/Section 73-22-34, Figure 1, to add the new parts.

2. Accomplishment Instructions

Part I - If the Electronic Engine Control is sent to one of the addresses listed in Paragraph 2.B.

A. The Source Demonstration requirements of this rework means that any facility not authorized to accomplish this rework either utilize the Authorized Vendors listed below or contact IAE Manager Maintenance Operations to determine if a qualification program can be initiated at their facility.

IAE-INTERNATIONAL AERO ENGINES AG
400 Main Street M/S 121-10
East Hartford, CT 06108 USA

B. Authorized Rework Vendors for this bulletin are listed below.

Customer Service Center
Hamilton Sundstrand Support Systems
97 Newberry Road
East Windsor, CT 06088 USA

OR

Hamilton Sundstrand Customer Support Center - Maastricht B. V.
Maastricht Aachen Airport
Horsterweg 7
P.O. Box 269
6190 AG Beek
The Netherlands

C. The designation by IAE of an authorized rework vendor indicates that the vendor has demonstrated the necessary capability to enable it to carry out the rework. However, IAE makes no warranties or representations concerning the qualifications or quality standards of the vendors to carry out the rework, and accepts no responsibility whatsoever for any work that may be carried out by a rework vendor, other than when IAE is listed as the vendor. Authorized rework vendors do not act as agents or representatives of IAE.

D. Removal Instructions

(1) Remove the Old P/N (Table 4) Electronic Engine Control by the procedure given in Reference (4), Chapter/Section 73-22-34, Removal Installation. Refer to Figure 1.

E. Rework Instructions

(1) Do a modification of the Old P/N (Table 4) Electronic Engine Control (See Reference (4), Chapter/Section 73-22-34, Fig/Item No. 01-280) and reidentify by the procedures given in Reference (2).

	Procedure	Supplementary Information
(a)	Send the Electronic Engine Control to the approved vendor to be modified. See Paragraph 2.B.	See Figure 1.

F. Installation Instructions

(1) Install the New P/N (Table 4), Electronic Engine Control (1 off) by the approved procedure given in Reference (4), Chapter/Section 73-22-34, Removal/Installation.

G. Recording Instructions

(1) A record of accomplishment is necessary.

Part II - If the Electronic Engine Control is Reprogrammed on site.

NOTE: This procedure can only be accomplished by maintenance personnel that have been trained by an IAE representative.

NOTE: In the following procedure, statements provided to show text copied from the computer screen:

are indented, bold, and as illustrated on this line.	E7975

However the number 'E7975' is a SB graphic reference and does NOT appear on the computer screen.

A. Isolate aircraft electrical system and gain access to the EEC by doing the pre-requisite procedures given in Job Set-up in Reference (4), Chapter/Section 73-22-34, Removal/Installation (the removal procedure).

NOTE: Do not turn on aircraft 28VDC power until instructed to do so in the following procedure.

NOTE: Reprogramming the EEC will clear the fault memory. It is recommended that a record of existing EEC faults be obtained before initiating reprogramming.

B. General

(1) Hamilton Sundstrand electronic Engine Control Model EEC150-20, software is programmed into the EEC using an IBM compatible computer and Hamilton Sundstrand supplied software.

(a) Disassembly of the EEC is not required.

(b) Data integrity of the Hamilton Sundstrand supplied software is performed as part of the reprogramming procedure.

(c) A bit-for-bit memory verification test is included as part of the reprogramming procedure.

(d) No functional, thermal cycle, or vibration testing is required for units reprogrammed in accordance with this Service Instruction.

(e) The EEC can be programmed at room ambient conditions or while it is installed on the engine.

(2) The tools specified in Paragraph 1. H. are necessary to accomplish this procedure.

C. Do the steps that follow to reprogram the Electronic Engine Control (EEC) without removing it from the engine.

(1) Verify that the model number on the identification plate of the unit is "EEC150-20".

(2) Record the current unit part number and the unit serial number from the nameplate. This information will input into your computer.

(3) Connect commercial power to all necessary reprogramming equipment.

(4) Remove the harness connector from the EEC connector marked J1 and connect the **programing harness connector** marked P1 to the EEC connector marked J1. Ensure that the red engagement stripe on the EEC connector J1 is fully covered.

(5) Remove the harness connector from the EEC connector marked J7 and connect the **programing harness connector** marked P7 to the EEC connector marked J7. Ensure that the red engagement stripe on the EEC connector J7 is fully covered.

(6) If the computer and power supply connections to the cables are permanent, skip to step C. (9).

(7) Connect the **programing harness connector** marked CH A UART to the IBM compatible computer UART board connectors for the channel A RS-422 Port (COM-3). Make sure that the connectors are properly mated.

(8) Connect the **programing harness connector** marked CH B UART to the IBM compatible computer UART board connectors for the channel B RS-422 Port (COM4). Make sure that the connectors are properly mated.

NOTE: UART connections can differ for different IBM Compatible Computers.

NOTE: It is important to verify that the connectors are correctly installed for correct loader operation. Hamilton Sundstrand recommends labeling the RS-422 COM3 port as CH A UART and COM4 port as CH B UART on the computer to reduce errors.

(9) If the EEC is powered by aircraft 28VDC power supply, skip to step C. (13)

(10) If the computer and power supply connections to the cables are not permanent, connect the opposite end of P3 and P9 cables to the 28VDC power supply.

(11) Remove the harness connector from the EEC connector marked J3 and connect the power supply harness connector marked P3 to the EEC connector marked J3. Ensure that the red engagement stripes on EEC connector J3 are fully covered.

(12) Remove the harness connector from the EEC connector marked J9 and connect the power supply harness connector marked P9 to the EEC connector marked J9. Ensure that the red engagement stripes on EEC connector J9 are fully covered.

(13) Turn on the aircraft 28VDC power supply to the EEC

(14) Locate the BOOT/BITE switches for channel A and channel B. Set the Boot/BITE switches to the ON (closed) position.

(15) Turn on the power to the IBM compatible computer.

NOTE: Please make sure that the Disk Drive "A" has no disks present, prior to power on of the computer.

(16) Wait for the MSDOS prompt "**C:\>**" to appear on the IBM compatible computer.

NOTE: The procedure uses disk drive "A" to identify the location of the floppy drive in the computer system. If your computer is configured with the 3.5 inch floppy drive at a different designation, substitute that designation into the procedure.

(17) Obtain the Hamilton Sundstrand reprogramming diskette which is given in Table 4 and Reference (2).

(a) Make sure that the write protection tab of the diskette is covering the "hole".

NOTE: If necessary, you can remove the stickers from the corner of the disk and move the protecting device to close the hole.

(b) Insert the diskette into the floppy drive designated as "A" on the IBM computer.

(18) The display will show the "**C:\>**". Type **a:** then press the **RETURN** key.

NOTE: Some computers have the **RETURN** key designated **ENTER**.

(19) The display will show the "**A:\>**" prompt.

(a) Type **LDR150** then press the **RETURN** key. this starts the UART programming utility.

1 Several messages will appear including the program identification, version number, time and the UTC/P&W document property rights notice.

2 If there is a configuration error on the diskette, the program will display the appropriate error message and abort the programming process. Refer to Table 3 for a summary of error code description and troubleshooting suggestions.

(20) The UART programming utility LDR150, will display the following message:

```
Enter operators name performing download : [ ] >
```

E7963

(a) The field between the brackets will always be empty the first time the program is executed on the diskette.

(b) Subsequent execution of the program will display the last name entered.

1 If the operator is the same, press the **RETURN** key to continue.

2 If a different name is present than the operator or no name is present, the operator should enter his/her name and press the **RETURN** key.

(21) The LDR150 program will display the following message:

```
WARNING–EEC Fault Memory Will Be Cleared By This Program.
If an EEC Fault Dump Is Requested prior to Programming,
enter Q to Quit or C to Continue [Q/C] :>
```

E7964

(a) If a fault dump has already been accomplished or is not required, type **C**, then press the **RETURN** key.

(b) If a fault dump is required or the operator wishes to terminate the programming procedure, type **Q**, then press the **RETURN** key.

(c) If the operator selects the quit option, turn off the 28VDC power to the EEC and go to step C.(37).

(22) The LDR150 program will now prompt with the following message:

```
Enter the 9 character EEC Serial Number  : [XXXX–XXXX]>
```

E7965

From the Hamilton Sundstrand nameplate, enter the nine character EEC serial number and press the **RETURN** key.

NOTE: For steps (23) and (24), if the EEC150-20 part number on the nameplate between the dashes is a single digit, enter a zero immediately preceding this digit.

Example: P/N 808050-4-030 would be entered as 808050-04-030.

(23) The LDR150 program will now prompt with the following message:

Enter the 13 character Current EEC HW Part No.: [XXXXX-XX-XXX]> E7966

From the Hamilton Sundstrand nameplate, enter the 13 character EEC Hardware Part Number and press the **RETURN** key.

(24) The LDR150 program will now prompt with the following message:

Enter the 13 character SB EEC HW Part No. : [XXXXX-XX-XXX]> E7967

From Table 4 and Reference (2), the Service Bulletin, enter the 13 character EEC Hardware Part Number and press the **RETURN** key.

(25) The LDR 150 program will now prompt with the following message:

Enter Trim Checksum Value for "XXXXXX.TRM" : E7968

The xxxxxx.xxx designation is the name of the Trim File being loaded to the EEC. From Table 4 and Reference (2), the Service Bulletin, enter the trim checksum value and press the **RETURN** key.

(26) The LDR150 program will now prompt with the following message:

Do you wish to reenter the above entries [Y/N/Q] : E7969

(a) To proceed with programming process, type **N**, then press the **RETURN** key. Continue with step C. (27).

(b) To correct any errors in the data entered, type **Y** then press **RETURN**. continue with step C. (20).

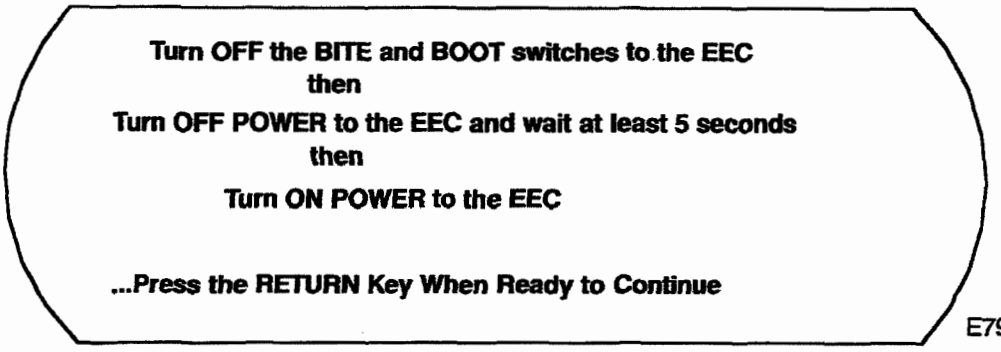
(c) To quit the programming process, type **Q**, then press **RETURN** . Turn off the 28VDC power to the EEC and continue with step C. (37).

(27) At this point the screen will be initialized to display the activity of the programming process.

(a) Status messages will scroll across the screen.

(b) If an error occurs, see Table 3 for a summary of error code description and troubleshooting suggestions.

(28) The LDR150 program will prompt with the following message:

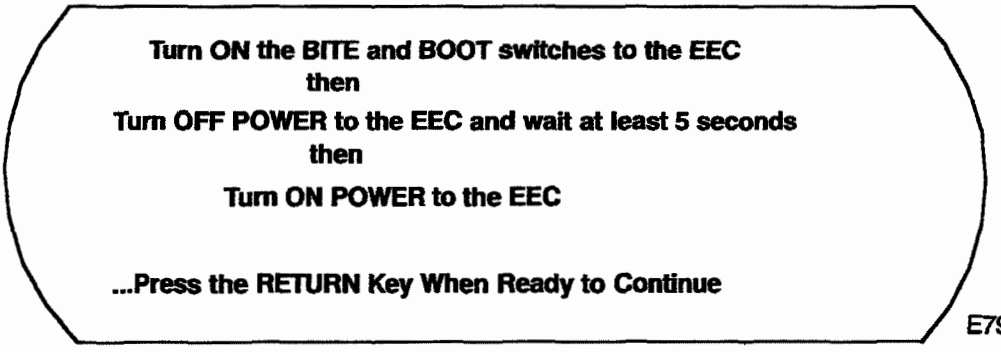


Locate the BOOT/BITE switches on your test equipment, and set the BOOT/BITE switches to the OFF (open) position.

(29) Switch off the 28VDC Aircraft supply to the EEC, wait 5 seconds, then switch on the 28VDC power supply to the EEC.

(30) On the IBM compatible computer, press the **RETURN** key.

(31) Wait until the LDR150 program prompts with the following message:

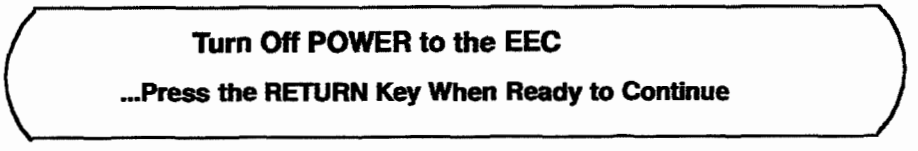


Locate the BOOT/BITE switches on your test equipment, and set the BOOT/BITE switches to the ON (closed) position.

(32) Switch off the 28VDC power supply to the EEC, wait 5 seconds, then switch on the 28VDC supply to the EEC.

(33) On the IBM compatible computer, press the **RETURN** key.

(34) Wait until the LDR150 program prompts with the following message:



Switch off the 28VDC supply to the EEC

(35) On the IBM compatible computer, press the **RETURN** key.

(36) The LDR150 program will now display the status of the programming process. Record the name of the log file for hard copy report of the process.

(a) If a successful programming occurred, the following message will be displayed:

******EEC PROGRAMMING SUCCESSFULLY COMPLETED******
Record the log file name "VLXXXX.LOG" for later printout.

E7973

If desired, record the log file name "VLXXXX.LOG" for later printout."

(b) If programming was unsuccessful, the following message will be displayed:

******DOWNLOAD PROCESS ABORTED – ERROR CODE "X"**
Record the log file name "VLXXXX.LOG" for later printout.

E7974

If desired, record the log file name "VLXXXX.LOG" for later printout."

The "X" refers to the type of error that caused the process to abort. Table 3 describes the error codes and action to be taken.

(37) Press the **RETURN** key to terminate the program and return to the MSDOS prompt **"A:\>"**.

(38) A paper copy of the log file can be made by the IBM compatible computer if a printer is available. You can do this as follows:

NOTE: You can remove the diskette, write protect the diskette, and move to a system with a printer if no printer is connected to the original system. Complete the commands listed below to make a paper copy.

(a) At the MSDOS prompt, type **PRINT VLXXX.LOG.**

(b) Press the **RETURN** key.

(c) Wait until the printer is finished before proceeding to the next step.

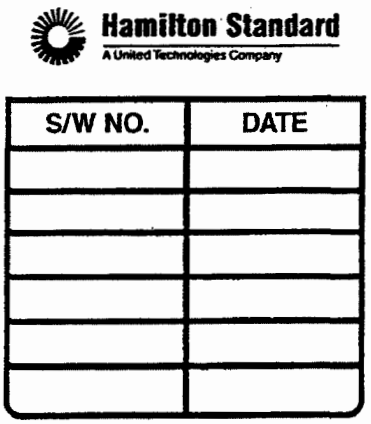
(d) Remove the diskette, write protect the diskette.

(39) Disconnect the EEC reprogramming electrical connectors from J1 and J7 and J3/J9, if applicable.

(40) Reconnect the aircraft electrical harness connectors to J1 and J7 and J3/J9, if applicable.

(41) Identify the Electronic Engine Control by the procedure as follows and in Reference (2).

(a) If not already installed, install the Software Identification Plate below the existing nameplate by the procedure specified in HS SB EEC150-20-73-16 Reference (2), as shown below:



E8146

(b) Use a ballpoint pen or its equivalent to put the last three digits of the HS HW New Part Number from Table 4 under "S/W No.", and the Date under "DATE", on the Software Identification Plate.

(c) Erase (scratch out) the existing HS HW Part Number and Date if previously marked on the Identification Plate.

(42) Close-up the engine and remove the remaining notices by doing the post-requisite procedures given in Job Close-up in Reference (4), Chapter/Section 73-22-34, Installation.

(43) Do the post-installation test specified in Reference (4), Chapter/Section 71-00-00, as required for Removal/Installation of an Electronic Engine Control.

(44) For this reprogramming diskette, make (add to) a record of accomplishment, listing diskette part number, operator, EEC serial number, and date.

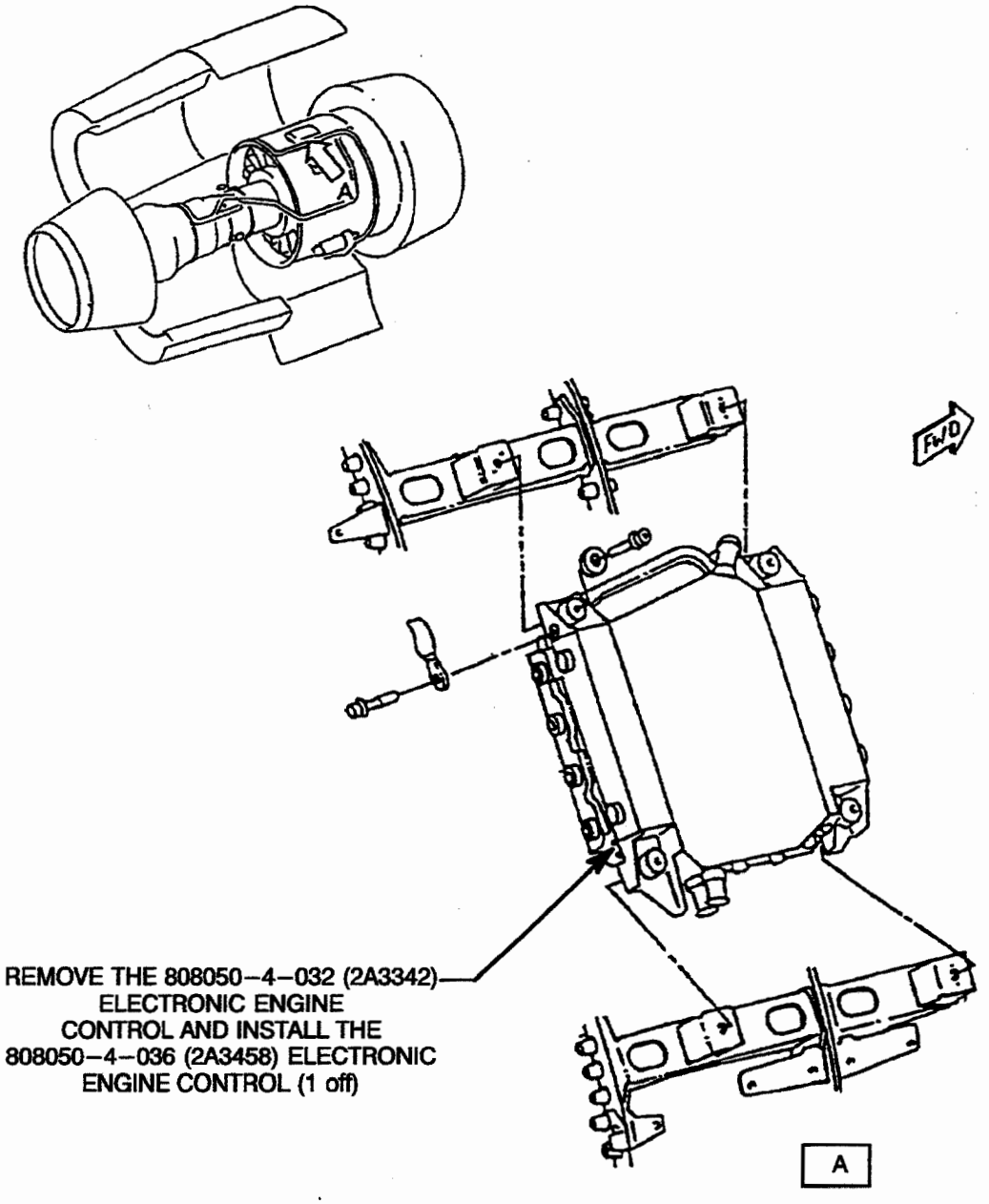
(45) When fleet reprogramming is complete, return reprogramming diskette and record of accomplishment to IAE representative, for return to IAE.

ERROR CODE	ERROR TYPE	ACTION
E1	EEC VERIFY ERROR - Data verify error in EEC - Compare failed or location could not be programmed	Try procedure 3 times, if still bad return EEC unit.
E2	COMMUNICATION ERROR - Communication problem between EEC and IBM compatible computer	Check BITE, cables, power supply. UART board, and EEC. Retry 3 times.
E3	CONFIGURATION ERROR - Configuration data comparison failed. (Possible Hardware P/N mismatch, EEC compatibility mismatch, Trim Checksum mismatch)	Operator data entered incorrect or incorrect data on existing nameplate. Check data - retry with the correct information.
E4	SYSTEM PROBLEM - Poor operating environment, bad disk, or program aborted by operator.	If the process was not terminated by the operator, check that the disk is not write protected, or replace disk and retry.

Table 3
Error Code Definitions

A5 SCN14/S				
	Old P/N	A5 SCN14/S New P/N	SB Line Reference Paragraph	Line
Reprogramming Diskette	n/a	819191-?(TBD)?	2. Part II	C. (17)
EEC: (HS) HW Part No.	808050-4-032	808050-4-036	2. Part I	D.(1), E.(1), F.(1),
			2. Part II	C. (24)
EEC: IAE P/N	2A3342	2A3458	2. Part I	D.(1), E.(1), F.(1)
Trim Checksum	n/a	?(TBD)?	2. Part II	C. (25)

Table 4
Reprogramming Input Reference Table



Location of the Electronic Engine Control (EEC)
Figure 1

3. Material Information

A. Kit associated with this bulletin.

None

B. Parts affected by this bulletin.

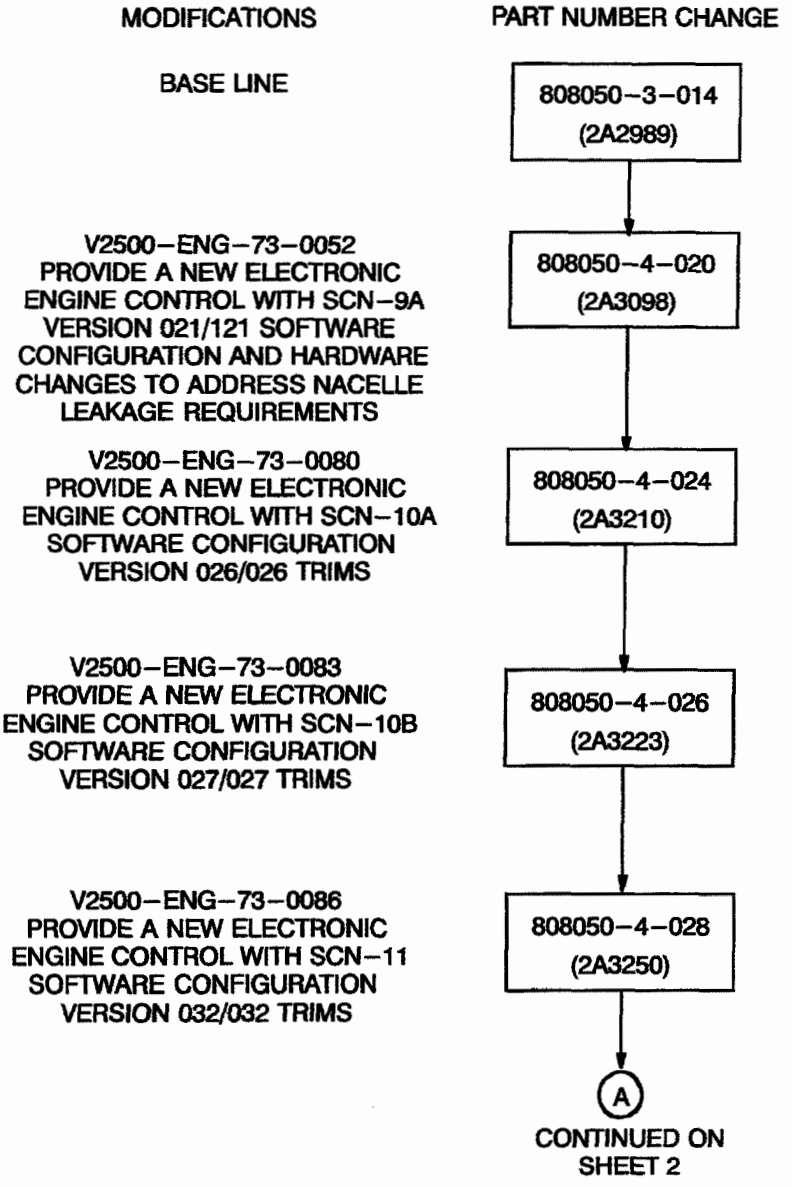
New Part No. (ATA No.)	Qty	Est'd Unit Price($)	Keyword	Old Part No. (IPC No.)	Instructions Disposition
Applicability: For each V2522-A5, V2524-A5, V2527-A5, V2527E-A5, V2527M-A5, V2530-A5 and V2533-A5 Engine to incorporate this Service Bulletin					
808050-4-036 (2A3458) (73-22-34)	1		Control, Electronic Engine	808050-4-032 (2A3342) (01-280 C)	(1D)(A)

C. Instructions/Disposition Code Statements:

(1D) The new part can be obtained through modification by the approved procedure in Reference (2). Purchase the new parts from or return the old parts for modification to one of the approved vendors listed in Paragraph 2. B. in the Accomplishment Instructions.

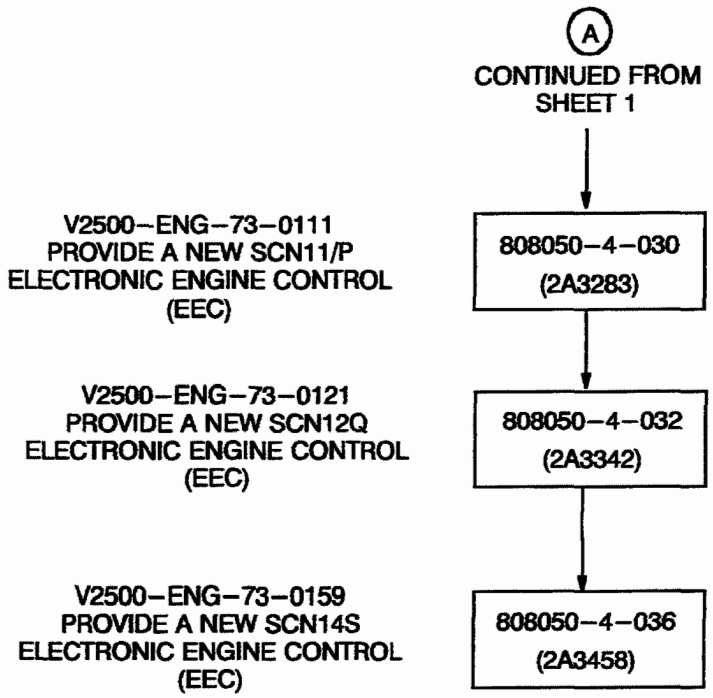
(A) The new part will be available approximately September, 1999.

NOTE: The estimated 1998 unit prices shown are provided for planning purposes only and do not constitute a firm quotation. Consult the IAE Price Catalog or contact IAE's Spare Parts Sales Department for information concerning firm prices.



E8148

Family Tree - Electronic Engine Control (EEC)
Ref. Catalog Sequence No. 73-22-34. Fig. 01 Item 280 C
Figure 2 (Sheet 1)



E8149

Family Tree - Electronic Engine Control (EEC)
Ref. Catalog Sequence No. 73-22-34. Fig. 01 Item 280 C
Figure 2 (Sheet 2)